

Remarks

Claims 1-3, 7 and 12-21 are pending.

The Examiner rejects claims 1, 10 and 13 (**now claims 1 and 13**) under 35 U.S.C. 112(1) as containing subject matter that is not described in the Specification in such a way as to reasonably convey to one skilled in the art that the Applicants had possession of the invention as now claimed. The Examiner objects to the exclusionary provisos. Applicants have merely sought to exclude compounds disclosed in the prior art. Such an exclusion is permitted under the rationale of In re Johnson, 194 U.S.P.Q. 187 (CCPA 1977).

The Examiner objects, with respect to claim 10, to the possibility of $-R_{12}$ for $-R_{11}$ and suggests it should be $-OR_{12}$. Claim 10 has been canceled.

The Examiner objects to the compounds of claim 13, particularly the last 10. The Examiner states that the compounds do not correspond to any of the compounds in the examples. The compounds are not expressly disclosed but fall within the general parameters of the preferred embodiments. For instance, preferred embodiment (a) of page 15 is encompassed by new claim 15, which is then further represented by specific compounds 1-4 in claim 14. Claim 16 is directed to preferred embodiment (b) on page 15, which is further exemplified by compounds 6, 7, 9, 14, 14, 16, 17 and 20 in claim 14. Claim 17 is directed to preferred embodiment (c) on page 15, which is further exemplified by compounds 10, 11, 12, 13, 19 in claim 14 and compounds 1, 2, 3, 4, 5, 7, 8, 10, 11, and 12 in claim 13.

The Examiner objects to claims 7 and 8 (**now claim 7**) for including an embedded preferred embodiment. With respect to claim 7, the relevant lines have been deleted.

The Examiner objects to the phrase "in treating" in claim 2. The phrase has been deleted. The Examiner also objects to claim 2 for not further limiting claim 7 from which it depends. The applicable subject matter from claim 7 has been incorporated into claim 2. The Examiner also objects to the phrase "an usual alkylating agent", which has been changed to "an alkylating agent".

The Examiner objects to claim 3 due to the phrase "compounds I according to". The preamble has been amended appropriately. The Examiner also objects to claim 3 since it only represents a subset of the compounds from claim 7. Claim 3 no longer depends from claim 7 and has been amended to ensure that the recited product and reactants are internally consistent. The term "generally" has been deleted as a modifier for the treatment pressure.

The Examiner objects to the compound formulae in general where $-NR_8R_9$ stand for a five- or six-membered heterocyclic radical including $-NR_5$. The Examiner outlines a possibility that the compound produces endless cyclic rings. The $-NR_8R_9$ elements has been deleted.

The Examiner does not understand the meaning of the phrase "branched alkyl groups or aralkyl groups, such as $-(CH_2)_n$ -aryl- $(CH_2)_m-$ in claim 8. Claim 8 has been canceled.

The Examiner maintains that the formula for julolidyl in claim 10 is improper. The Examiner also notes that claim 10 defines R_{11} without it being used anywhere. Claim 10 has been canceled.

The Examiner correctly notes that claim 12 should depend from claim 1. Claim 12 has been amended accordingly.

The Examiner rejects claims 2, 4, 5 and 7 (**now claims 2 and 7**) under 35 U.S.C. 102 as being anticipated by U.S. Pat. No. 4,585,878 ("Jost et al."). The Examiner maintains her obviousness rejection of claim 6 (**now canceled**) under 35 U.S.C. 103 in view of Jost. The Examiner rejects claim 13 under 35 U.S.C. 103 as being unpatentable over Jost. The Examiner asserts that it would be obvious to modify the generically disclosed compounds of Jost to arrive at the instantly claimed compounds. Applicants respectfully traverse these rejections.

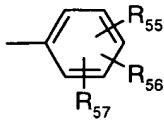
The DPP compounds of formulae X to XIV of Jost are substituted by phenyl in the positions corresponding to Ar_1 and Ar_2 . Claim 2 is drawn to a process for preparing the compounds of claim 7. Claim 7 is drawn to fluorescent diketopyrrolopyrrole compounds. In relevant part, claim 7 does not encompass substituted ^{phenyl}aryl groups for Ar_1 and Ar_2 . Jost does not provide any motivation for employing the instantly reciting aromatic groups (Ar_1 and Ar_2) in claim 7. Claim 13 is drawn DPP

compounds that can have a phenyl ring, but has more complicated aryl substitution than contemplated in Jost. The specific compounds of claim 13 are neither disclosed nor suggested within Jost.

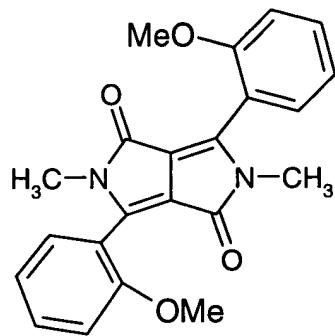
The Examiner rejects claims 1, 4-7 and 12 (**now 1, 7 and 12**) under 35 U.S.C. 102(b) as being anticipated by published European patent application 499,011 ("EP '011"). The Examiner rejects claims 1, 2, 4-7 and 12 (**now 1, 2, 7 and 12**) under 35 U.S.C. 103 as being obvious in view of EP '011 and Jost. Applicants respectfully traverse these rejections.

Claim 1 is drawn to an electroluminescent device having a light emitting layer containing at least one selected diketopyrrolopyrrole compound represented by formula I or III where, in relevant

part, Ar₁ and Ar₂ can be



EP '011 describes an organic EL element comprising a DPP compound in examples 3 and 7. The electroluminescent device shown therein comprises an anode, a hole transporting layer, a light-emitting layer of 2,5-dimethyl-3,6-di(o-methoxyphenyl)pyrrolo[3,4-c]pyrrole

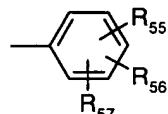


and polycarbonate in a 1:1 ratio and 2,5-dimethyl-3,6-di(phenyl)pyrrolo[3,4-c]pyrrole, respectively and a cathode is disclosed. The substituents for Ar1 and Ar2 do not include alkoxy groups. The compounds and device shown in EP '011 do not anticipate the invention of claim 1.

Furthermore, the light emitting layer compound 2,5-dimethyl-3,6-di(phenyl)pyrrolo[3,4-c]pyrrole does not show electroluminescence in thin film type organic EL devices. The emission from

the device using 2,5-dimethyl-3,6-di(o-methoxyphenyl)pyrrolo[3,4-c]pyrrole is heterogeneous/uneven on the emission area of the device (cf. Comparative Examples 1 to 3). According to EP '011 only highly crystalline organic pigments should be employed for a light emitting material (see page 7, lines 2 to 7). However, one of the requirements for light emitting materials is its morphological stability. Crystalline materials show a tendency to be morphologically modulated in the evaporated film. Therefore, the compounds of EP '011 are not suitable for the claimed application of claim 1.

The Examiner rejects claim 7 under 35 U.S.C. 102(b) as being anticipated by published German reference 3,713,459 ("DE '459"). The Examiner points to the compounds of formulae (2a), (2b), (2c) and (2d), which the Examiner states can have substituted phenyl groups. Applicants respectfully traverse this rejection.



The compounds of claim 7 do not include . The DPP compounds 2b, 2c and 2d as shown on page 3 of DE '459 do not anticipate the compound of claim 7 herein.

The Examiner rejects claims 8-11 under 35 U.S.C. 103 as being unpatentable over U.S. Pat. No. 5,298,063 ("Mizuguchi et al."). The Examiner asserts that it would have been obvious to modify the compounds of Mizuguchi to arrive at the instantly claimed compounds. Claims 8-11 have been canceled thereby rendering this rejection moot.

The Examiner provisionally rejects claims 1-12 under the judicially created doctrine of obviousness-type double patenting over claims 2-13 in Copending application No. 09/753,080. If this case appears to be otherwise in condition for allowance, Applicants shall submit a terminal disclaimer.

The Examiner also rejects claims 2-7 under 35 U.S.C. 102(e) as being anticipated by the '080 Application. The '080 Application has a US filing date of September 7, 2000. Applicants shall submit

a certified translation to establish a date of invention prior to the effective filing date of the '080 Application.

Respectfully submitted,



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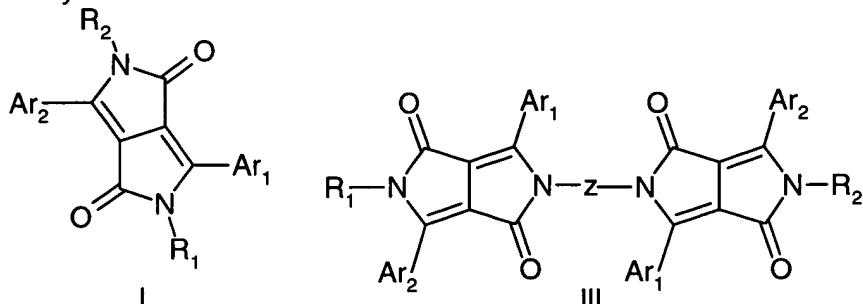
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Amended Claims with underlining and bracketing

1. (twice amended) Electroluminescent device comprising in this order

- (a) an anode
 - (b) a hole transporting layer
 - (c) a light-emitting layer
 - (d) optionally an electron transporting layer and
 - (e) a cathode

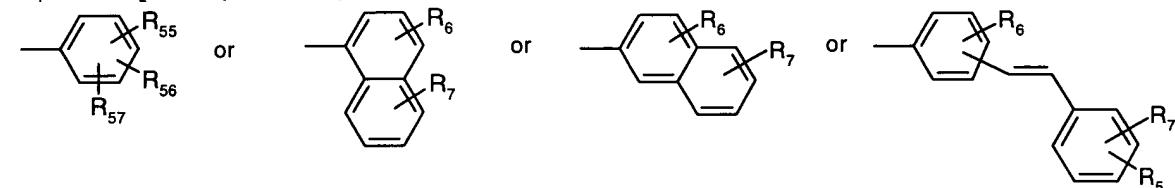
and a light-emitting substance, wherein the light-emitting substance is a diketopyrrolopyrrole ("DPP") represented by formula I or formula III



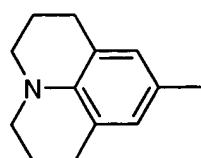
wherein R₁ and R₂, independently from each other, stand for C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₃alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄, independently from each other stand for hydrogen, C₁-C₄alkyl, or phenyl which can be substituted one to three times with C₁-C₃ alkyl,
Ar₃ stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈alkyl,

Ar_3 stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with $\text{C}_1\text{-}\text{C}_8$ alkyl, $\text{C}_1\text{-}\text{C}_8$ alkoxy, halogen or phenyl, which can be substituted with $\text{C}_1\text{-}\text{C}_8$ alkyl or $\text{C}_1\text{-}\text{C}_8$ alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4,

Ar_1 and Ar_2 , independently from each other, stand for

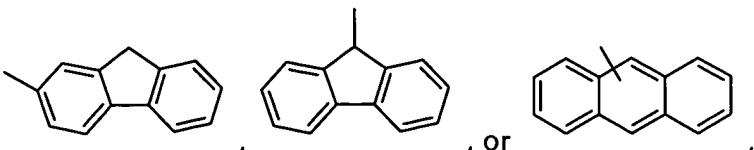


or  or julodidyl,



, which can be substituted one to four times with C₁-C₄alkyl, C₁-C₄alkoxy, or phenyl

or



wherein

R_5 , R_6 and R_7 , independently from each other, stand for hydrogen, cyano, halogen, $C_1\text{-}C_6$ alkyl, -NR_8R_9 , -OR_{10} , -S(O)_nR_8 , -Se(O)_nR_8 , or phenyl, which can be substituted one to three times with $C_1\text{-}C_8$ alkyl or $C_1\text{-}C_8$ alkoxy,

R_{55} , R_{56} and R_{57} , independently from each other, stand for hydrogen, cyano, halogen, $C_1\text{-}C_6$ alkyl, -NR_8R_9 , -OR_{10} , -S(O)_nR_8 , -Se(O)_nR_8 , or phenyl, which can be substituted one to three times with $C_1\text{-}C_8$ alkyl or $C_1\text{-}C_8$ alkoxy,

with the proviso that R_{56} and R_{57} do not simultaneously stand for hydrogen,

wherein R_8 and R_9 , independently from each other, stand for hydrogen, phenyl, $C_1\text{-}C_{25}$ -alkyl, $C_5\text{-}C_{12}$ -cycloalkyl, $\text{-CR}_3R_4\text{-}(CH_2)_m\text{-Ph}$, R_{10} , wherein R_{10} stands for $C_6\text{-}C_{24}$ -aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms,

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with $C_1\text{-}C_8$ alkyl, $C_1\text{-}C_8$ alkoxy, or halogen, or

R_8 and R_9 stand for -C(O)R_{11} , wherein R_{11} can be $C_1\text{-}C_{25}$ -alkyl, $C_5\text{-}C_{12}$ -cycloalkyl, R_{10} , -OR_{12} or $\text{-NR}_{13}R_{14}$, wherein R_{12} , R_{13} , and R_{14} stand for $C_1\text{-}C_{25}$ -alkyl, $C_5\text{-}C_{12}$ -cycloalkyl, $C_6\text{-}C_{24}$ -aryl, or

R_5 , R_6 and R_7 , independently of one another, stand for a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the aryl and heterocyclic radical can be substituted one to three times with $C_1\text{-}C_8$ alkyl or $C_1\text{-}C_8$ alkoxy, or -NR_8R_9 ,

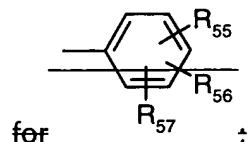
stands for a five- or six-membered heterocyclic radical in which R_8 and R_9 together stand for tetramethylene, pentamethylene, $\text{-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-}$, or

$\text{-CH}_2\text{-CH}_2\text{-NR}'_5\text{-CH}_2\text{-CH}_2\text{-}$, wherein R'_5 , independently from each other, stand for hydrogen, cyano, halogen, $C_1\text{-}C_6$ alkyl, -NR_8R_9 , -OR_{10} , -S(O)_nR_8 , -Se(O)_nR_8 , or phenyl, which can be substituted one to three times with $C_1\text{-}C_8$ alkyl or $C_1\text{-}C_8$ alkoxy, and n stands for 0, 1, 2 or 3,

and wherein Z stands for a diradical selected from the group consisting of a single bond, C_2 - C_6 alkylene, which can be substituted one to three times with $C_1\text{-}C_8$ alkyl, $C_1\text{-}C_8$ alkoxy, or phenyl,

phenylene or naphthylene, wherein in case of the DPP of formula III R_{55} , R_{56} and R_{57} , independently from each other, can also stand for $C_1\text{-}C_6$ alkyl and R_{56} and R_{57} can also stand simultaneously for hydrogen.

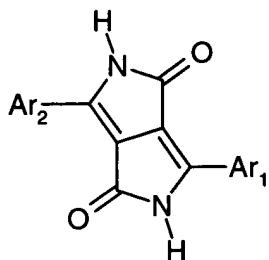
with the proviso that R_6 and R_7 do not stand simultaneously for hydrogen, if Ar1 and Ar2 stand



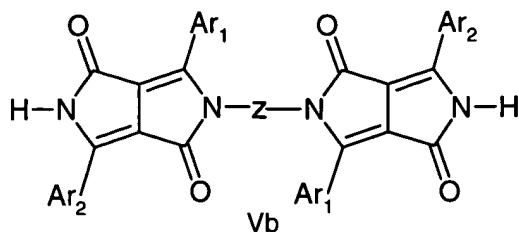
for ;

with the proviso that 2,5-dimethyl-3,6-di(p-methylphenyl)pyrrole[3,4-c]pyrrole is excluded.

2. (twice amended) Process for the preparation of a compound represented by formula I or III according to claim 7 in treating comprising in a first step the DPP derivative of formula Va or formula Vb

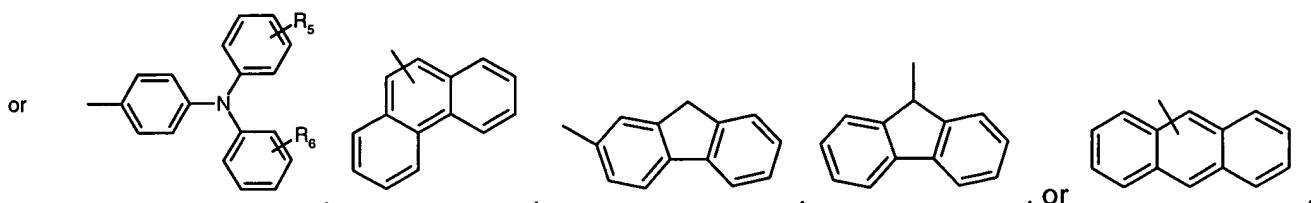
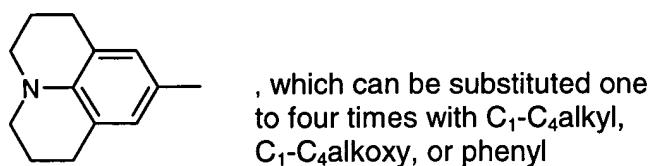
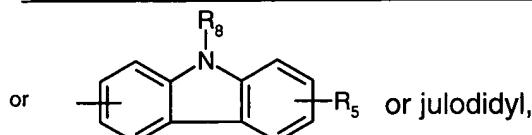
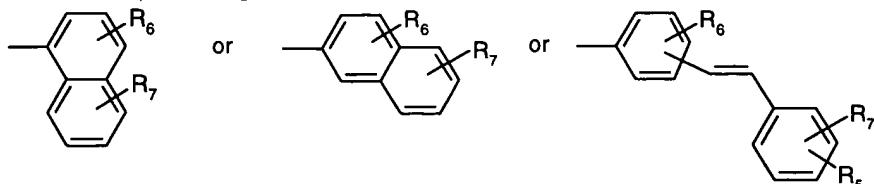


Va



Vb

wherein Ar₁ and Ar₂ are as defined in claim 7 independently from each other,



wherein

R₅, R₆ and R₇, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

wherein R₈ and R₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms,

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, or halogen, or

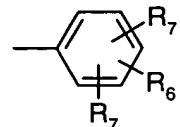
R₈ and R₉ stand for -C(O)R₁₁, wherein R₁₁ can be C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, R₁₀, -OR₁₂ or -NR₁₃R₁₄, wherein

R₁₂, R₁₃, and R₁₄ stand for C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, C₆-C₂₄-aryl,

or

R₅, R₆ and R₇, independently of one another, stand for a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three

hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,
or -NR₈R₉ stands for a five- or six-membered heterocyclic radical in which R₈ and R₉ together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂- or
-CH₂-CH₂-NR'-CH₂-CH₂-, and n stands for 0, 1, 2 or 3, wherein R', independently from each other, stand for hydrogen, cyano, halogen, C₁-C₈alkyl, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,
and wherein Z stands for a diradical selected from the group consisting of a single bond, C₂-C₆alkylene, which can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, or phenyl,
phenylene or naphthylene, with the proviso that R₆ and R₇ do not stand simultaneously for hydrogen

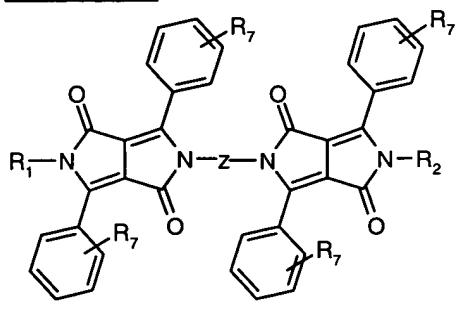


wherein in case of the DPP represented by formula III Ar₁ and Ar₂ can also stand for
wherein R₅, R₆ and R₇, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

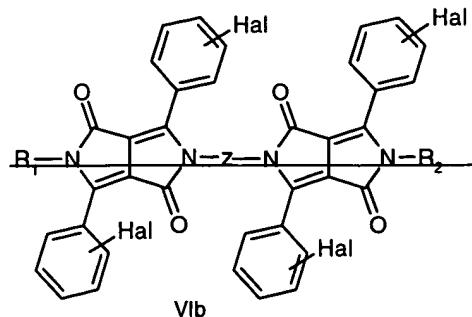
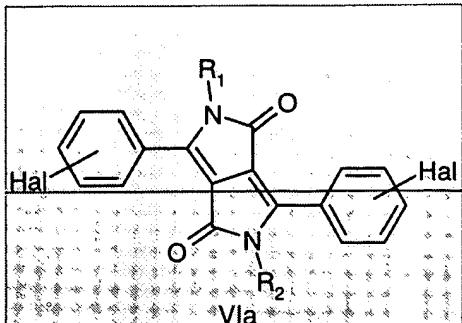
with a base, then, in a second step, treating the reaction mixture obtained in the first step with an usual alkylating agent, wherein in the first step the base is a hydride, an alkali metal alkoxide or a carbonate, and the alkylating agent is a sulfonate, tosylate, mesylate, carbonate, sulfate, or halogen compound of the formula (R₁)₁ or ₂X, wherein X stands for SO₃-, (p-Me-phenyl)SO₃-, (2,4,6-trimethyl-phenyl)-, SO₃-, -CO₃-, -SO₄-, or halogen, or a mixture of (R₁)₁ or ₂X and (R₂)₁ or ₂X, wherein R₁ and R₂ are as defined in claim 7 independently from each other, C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₈alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄ independently from each other stand for hydrogen or C₁-C₄alkyl, or phenyl which can be substituted one to three times with C₁-C₈alkyl.

Ar₃ stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, halogen or phenyl, which can be substituted with C₁-C₈alkyl or C₁-C₈alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4.

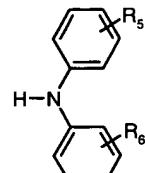
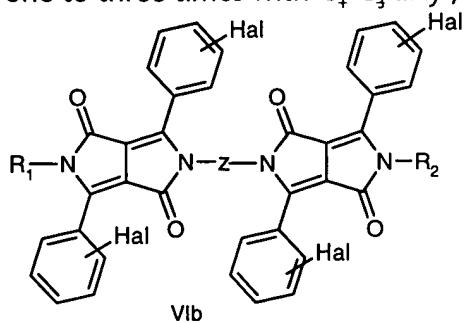
3. (twice amended) Process for the preparation of compounds 1 according to claim 7 represented by formula IIIa



comprising (a) treating in a first step the DPP derivative of formula VIa or formula VIb



wherein R_1 and R_2 are independently from each other, hydrogen, C_1-C_{25} -alkyl, allyl which can be substituted one to three times with C_1-C_3 -alkyl or Ar_3 , or $CR_3R_4-(CH_2)_m-Ar_3$, wherein R_3 and R_4 independently from each other stand for hydrogen, C_1-C_3 -alkyl, or phenyl which can be substituted one to three times with C_1-C_3 -alkyl, Hal stands for halogen



wherein R_1 stand for $-NR_8R_9$, $-OR_{10}$, $-S(O)_nR_8$, $-Se(O)_nR_8$, or $-S(O)R'_8$, $-Se(O)R'_8$, wherein R_5 and R_6 , independently from each other, stand for hydrogen, cyano, halogen, C_1-C_6 -alkyl, $-NR'_8R'_9$, $-OR_{10}$, $-S(O)_nR'_8$, $-Se(O)_nR'_8$, wherein R_8 and R_9 , independently from each other, stand for hydrogen, phenyl, C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, $-CR_3R_4-(CH_2)_m-Ph$, R_{10} , wherein R_{10} stands for C_6-C_{24} -aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C_1-C_8 -alkyl, C_1-C_8 -alkoxy, or halogen, or R_8 and R_9 stand for $-C(O)R_{11}$, wherein R_{11} can be C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, R_{10} , $-OR_{12}$ or $-NR_{13}R_{14}$, wherein R_{12} , R_{13} , and R_{14} stand for C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, C_6-C_{24} -aryl, R'_8 and R'_9 , independently from each other, stand for hydrogen, phenyl, C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, $-CR_3R_4-(CH_2)_m-Ph$, R_{10} , wherein R_{10} stands for C_6-C_{24} -aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C_1-C_8 -alkyl, C_1-C_8 -alkoxy, or halogen, or $-NR_8R_9$ stands for a five- or six-membered heterocyclic radical in which R_8 and R_9 , together stand for tetramethylene, pentamethylene, $-CH_2-CH_2-O-CH_2-CH_2-$, or

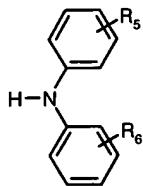
-CH₂-CH₂-NR', wherein R', independently from each other, stand for hydrogen, cyano, halogen, C₁-C₈alkyl, -OR₁₀, -S(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy, and n stands for 0, 1, 2 or 3,

R' and R', independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ is as defined above, or

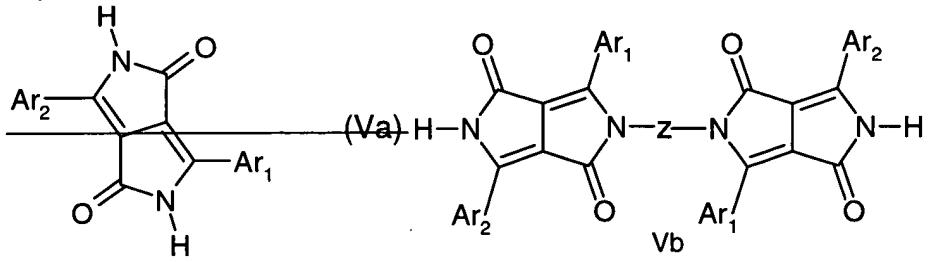
R' and R', stand for -C(O)R₁₁, wherein R₁₁ is as defined above,

or -NR'R', stands for a five- or six-membered heterocyclic radical in which R' and R', together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂-, or -CH₂-CH₂-NR'-CH₂-CH₂-, wherein R' stand for hydrogen, cyano, halogen, C₁-C₈alkyl, -OR₁₀, -S(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy, and n is as defined above,

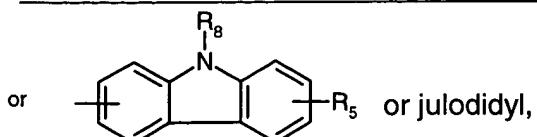
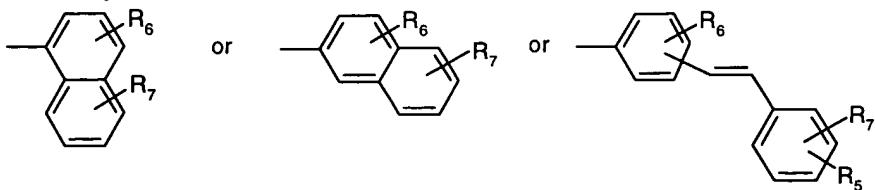
R₁ and R₂ are independently from each other, hydrogen, C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₈alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄ independently from each other stand for hydrogen, C₁-C₄alkyl, or phenyl which can be substituted one to three times with C₁-C₃, Hal stands for halogen, with a nucleophilic agent selected from -NR₈R₉, -OR₁₀, -S(O)_nR₈,

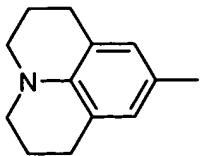


Se(O)_nR₈, or a secondary amine, HNR₈R₉, a thiol, HSR₈, HS(O)_nR₈, an alcohol, HOR₁₀, a diselenide, or R₈(O)_nSe-Se(O)_nR₈, in a molar ratio of DPP VIa or VIb:nucleophilic agent in the range of 1.2:1 to 0.8:1, or, if R₂ has the same meaning as R₁ in the range of from 1:2.5 to 1:1, in the presence of an anhydrous dipolar aprotic solvent, and of an anhydrous base in an amount in the range of from 0.1 to 15 moles per mole of the nucleophilic agent, at a temperature in the range of from 100 to 220°C and under a pressure generally in the range of from 100 to 300 kPa, and optionally isolating the obtained compound

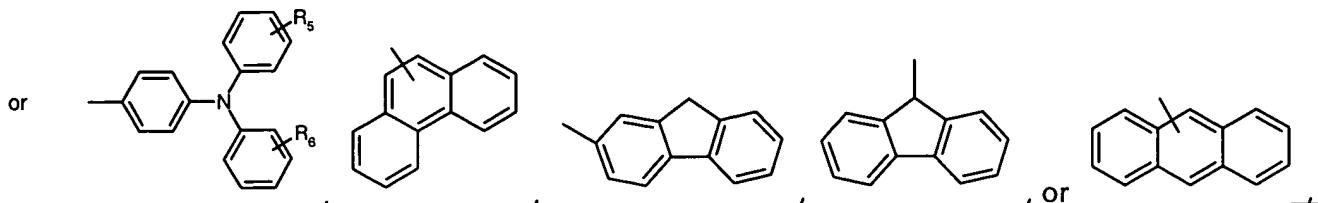


(b) then treating the obtained compound Va or Vb, wherein Ar₁ and Ar₂ are independently from each other, aryl radicals,





, which can be substituted one to four times with C₁-C₄alkyl, C₁-C₄alkoxy, or phenyl



wherein

R₅, R₆ and R₉, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

wherein R₈ and R₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms,

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, or halogen, or

R₈ and R₉ stand for -C(O)R₁₁, wherein R₁₁ can be C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, R₁₀, -OR₁₂ or -NR₁₃R₁₄, wherein

R₁₂, R₁₃, and R₁₄ stand for C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, C₆-C₂₄-aryl,

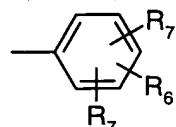
or

R₅, R₆ and R₉, independently of one another, stand for a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

or -NR₈R₉ stands for a five- or six-membered heterocyclic radical in which R₈ and R₉ together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂-, or

-CH₂-CH₂-NR'_n-CH₂-CH₂-, and n stands for 0, 1, 2 or 3, wherein R'_n, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₄alkyl, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

and wherein Z stands for a diradical selected from the group consisting of a single bond, C₂-C₆alkylene, which can be substituted one to three times with C₁-C₄alkyl, C₁-C₄alkoxy, or phenyl, phenylene or naphthylene, with the proviso that R₆ and R₉ do not stand simultaneously for hydrogen

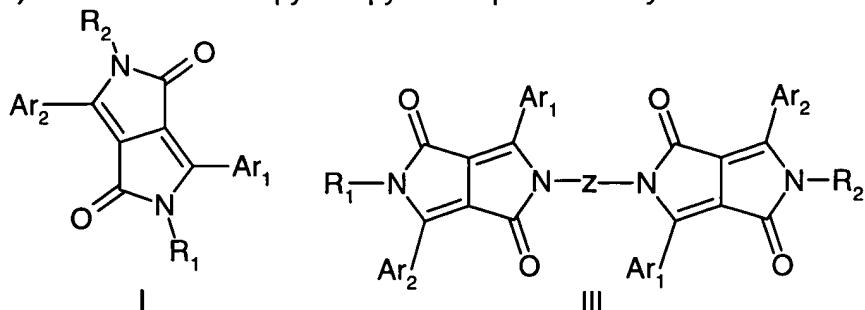


wherein in case of the DPP represented by formula III Ar₁ and Ar₂ can also stand for

wherein R₅, R₆ and R₉, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy,

with a base, thereafter in a second step, treating the reaction mixture obtained in the first step of (b) with an alkylating agent, wherein in the first step of (b) the base is a hydride, an alkali metal alkoxide or a carbonate, and the alkylating agent is a ~~sulfonate, tosylate, mesylate, carbonate, sulfate, or halogen~~ compound of the formula $(R_1)_{1 \text{ or } 2}X$, wherein X stands for SO_3^- , $(\text{p-Me-phenyl})\text{-SO}_3^-$, $(2,4,6\text{-trimethyl-phenyl})\text{-SO}_3^-$, $-\text{CO}_3^-$, $-\text{SO}_4^-$, or halogen, or a mixture of $(R_1)_{1 \text{ or } 2}X$ and $(R_2)_{1 \text{ or } 2}X$.

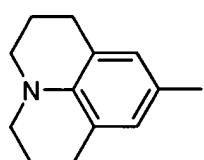
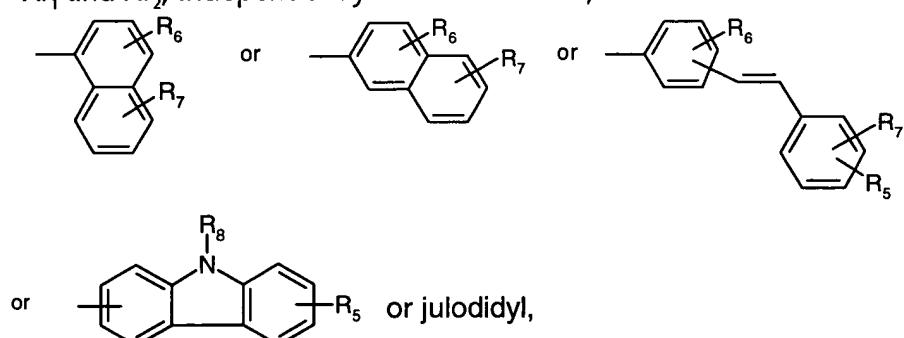
7. (twice amended) Fluorescent diketopyrrolopyrrole represented by formula I or formula III



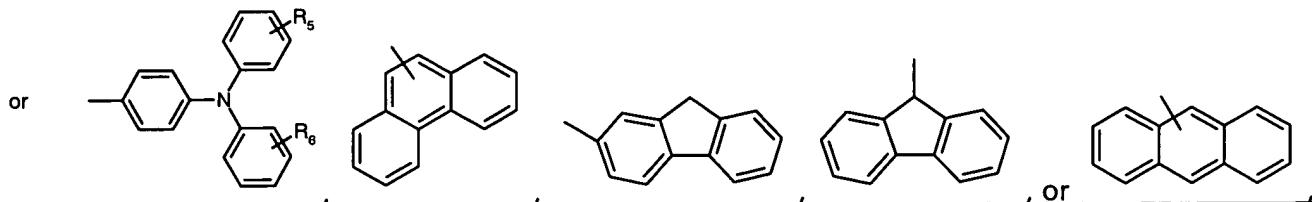
wherein R₁ and R₂, independently from each other, stand for C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₃-alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄ independently from each other stand for hydrogen or C₁-C₄-alkyl, or phenyl which can be substituted one to three times with C₁-C₃-alkyl,

Ar_3 stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with $C_1\text{-}C_8$ alkyl, $C_1\text{-}C_8$ alkoxy, halogen or phenyl, which can be substituted with $C_1\text{-}C_8$ alkyl or $C_1\text{-}C_8$ alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4,

Ar, and Ar., independently from each other, stand for



, which can be substituted one to four times with C₁-C₄alkyl, C₁-C₄alkoxy, or phenyl



wherein

R_5 , R_6 and R_7 , independently from each other, stand for hydrogen, cyano, halogen, C_1-C_6 -alkyl, $-NR_8R_9$, $-OR_{10}$, $-S(O)_nR_8$, $-Se(O)_nR_8$, or phenyl, which can be substituted one to three times with C_1-C_8 -alkyl or C_1-C_8 -alkoxy,

wherein R_8 and R_9 , independently from each other, stand for hydrogen, phenyl, C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, $-CR_3R_4-(CH_2)_m-Ph$, R_{10} , wherein R_{10} stands for C_6-C_{24} -aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms,

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C_1-C_8 -alkyl, C_1-C_8 -alkoxy, or halogen, or

R_8 and R_9 stand for $-C(O)R_{11}$, wherein R_{11} can be C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, R_{10} , $-OR_{12}$ or $-NR_{13}R_{14}$, wherein

R_{12} , R_{13} , and R_{14} stand for C_1-C_{25} -alkyl, C_5-C_{12} -cycloalkyl, C_6-C_{24} -aryl,

or

R_5 , R_6 and R_7 , independently of one another, stand for a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the aryl and heterocyclic radical can be substituted one to three times with C_1-C_8 -alkyl or C_1-C_8 -alkoxy, or $-NR_8R_9$ stands for a five- or six-membered heterocyclic radical in which R_8 and R_9 together stand for tetramethylene, pentamethylene, $-CH_2-CH_2-O-CH_2-CH_2-$, or $-CH_2-CH_2-NR'_5-CH_2-CH_2-$, and n stands for 0, 1, 2 or 3, wherein R'_5 independently from each other, stand for hydrogen, cyano, halogen, C_1-C_6 -alkyl, $-NR_8R_9$, $-OR_{10}$, $-S(O)_nR_8$, $-Se(O)_nR_8$, or phenyl, which can be substituted one to three times with C_1-C_8 -alkyl or C_1-C_8 -alkoxy,

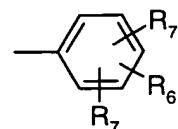
and wherein Z stands for a diradical selected from the group consisting of a single bond, C_2-C_6 -alkylene, which can be substituted one to three times with C_1-C_4 -alkyl, C_1-C_4 -alkoxy, or phenyl, phenylene or naphthylene, with the proviso that R_6 and R_7 do not stand simultaneously for hydrogen

or

$R_1=R_2=C_1-C_6$ -alkyl, $Ar_1=Ar_2=phenyl$, $R_7=-NR_8R_9$ in 4-position, $R_5=R_6=hydrogen$, and $R_8=R_9=C_1-C_6$ -alkyl or phenyl;

$R_1=R_2=C_1-C_6$ -alkyl, $-(CH_2)_m-Ph$, $Ar_1=Ar_2=phenyl$, $R_5=R_6=hydrogen$, $R_7=-OR_{10}$, $-N(R_8)_2$ or unsubstituted or substituted phenyl in para-position, and $R_8=C_1-C_6$ -alkyl, phenyl or a heterocyclic radical, both unsubstituted or substituted, or C_5-C_{12} -cycloalkyl; or

$R_1=R_2=-CH_2-Ph$, wherein phenyl can be substituted with phenyl, naphthyl or C_1-C_6 -alkyl up to two times, $Ar_1=Ar_2=phenyl$, $R_5=R_6=hydrogen$, $R_7=C_1-C_6$ -alkyl or phenyl,

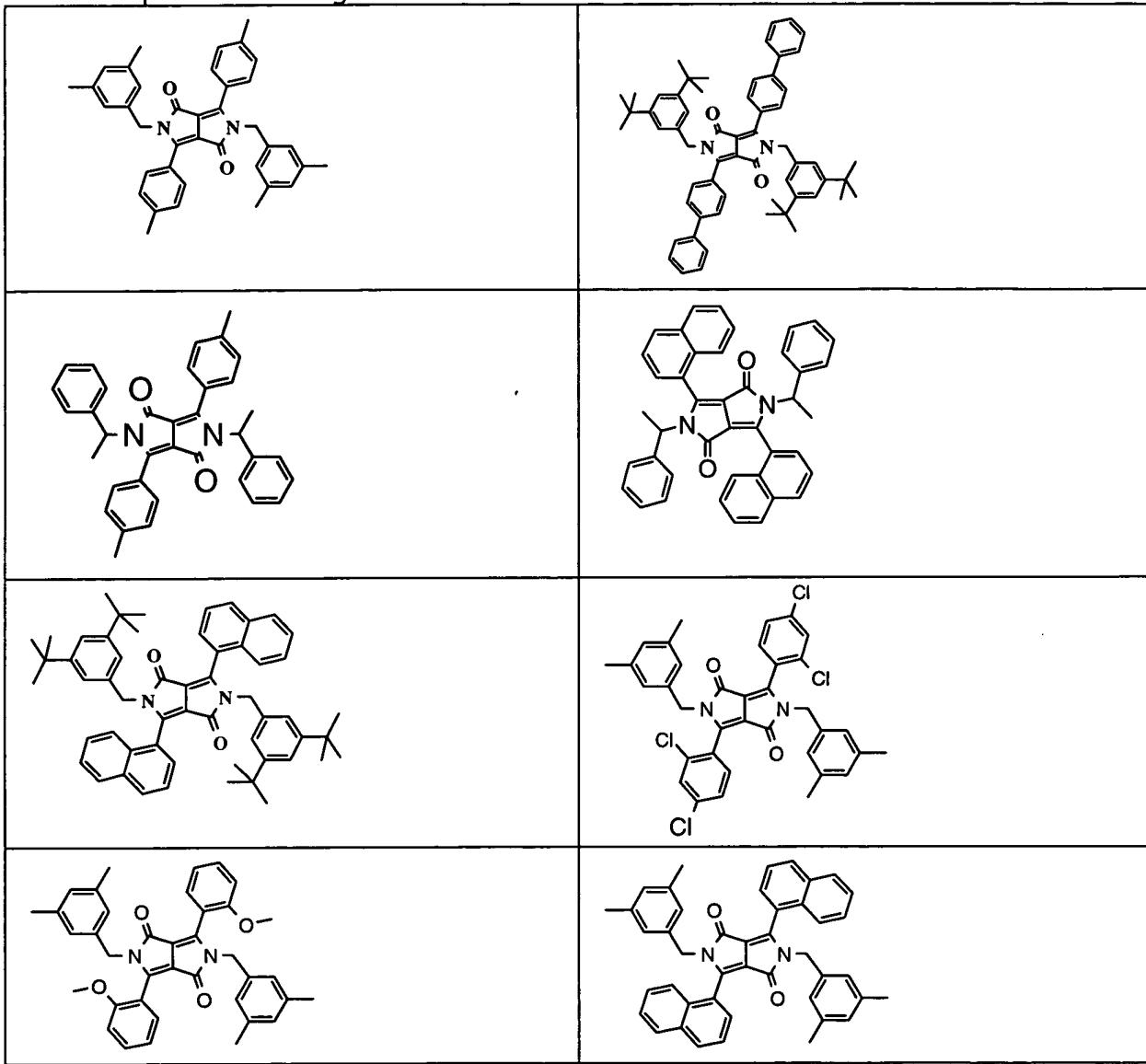


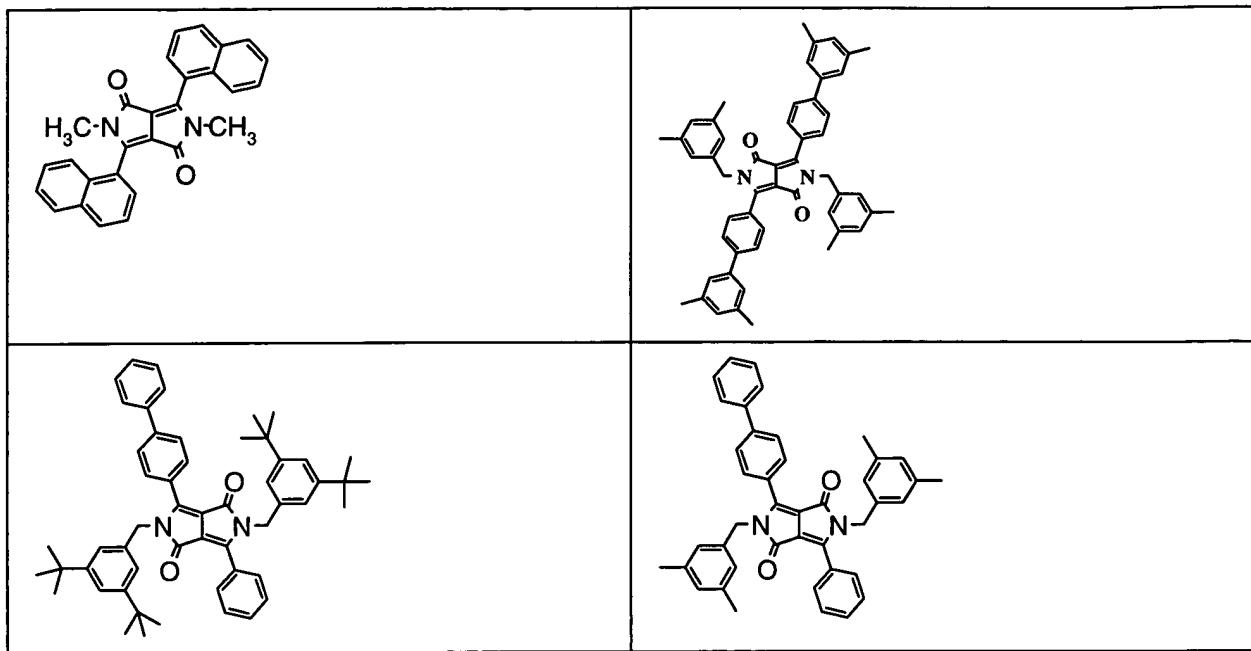
wherein in case of the DPP represented by formula III Ar_1 and Ar_2 can also stand for $+$, wherein R_5 , R_6 and R_7 , independently from each other, stand for hydrogen, cyano, halogen, C_1-C_6 -alkyl,

-NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy.

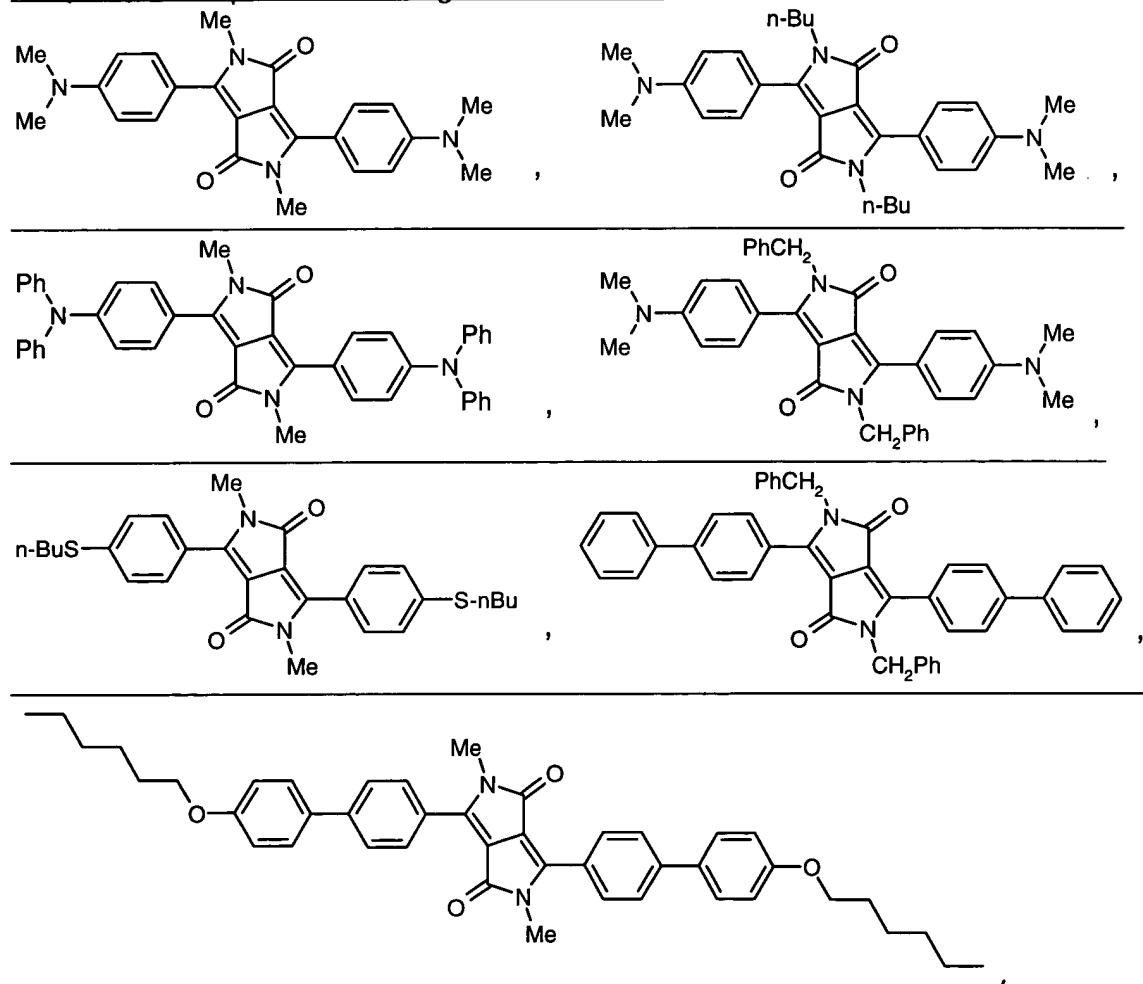
12. (amended) An electroluminescent device according to claim 1 wherein R₈ and R₉ together stand for -CH₂-CH₂-O-CH₂-CH₂-.

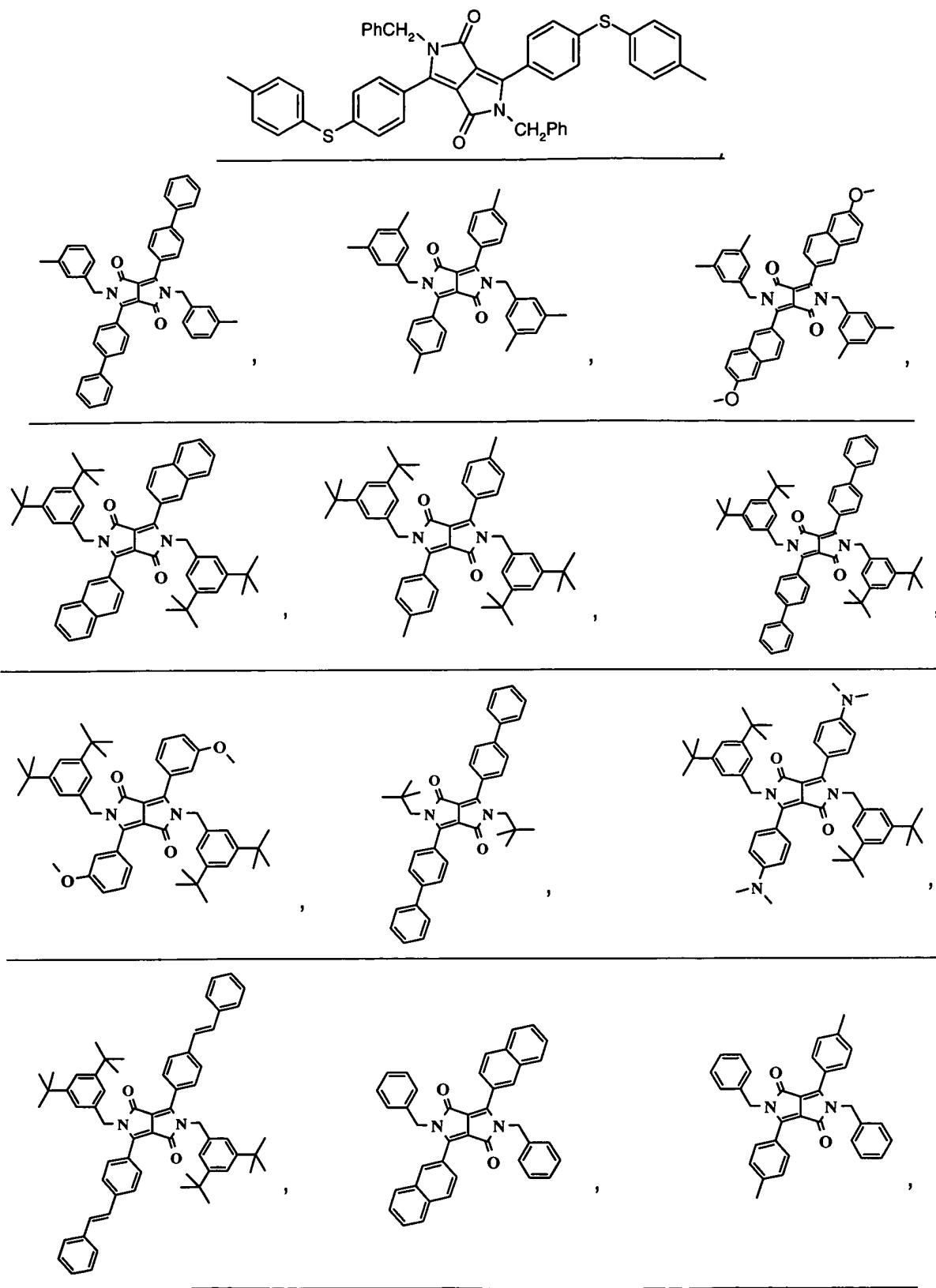
13. A compound according to the formulae

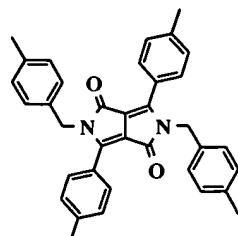
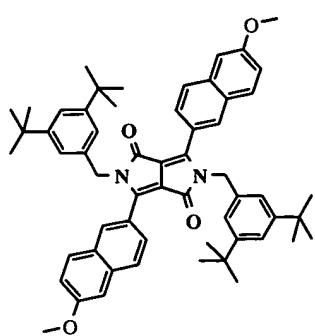




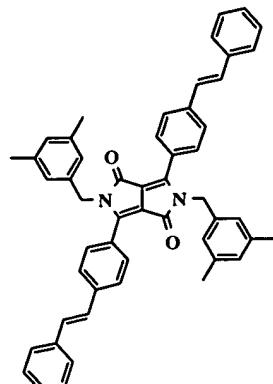
14. (new) A compound according to the formulae



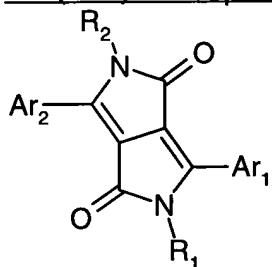




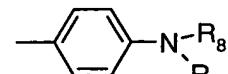
and



15. (new) A compound of formula I

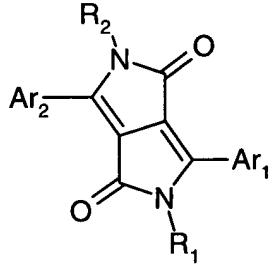


I



wherein R₁ and R₂ are C₁-C₈alkyl, Ar₁ and Ar₂ are a group of formula -OR₉, -N(R₈)₂, or unsubstituted or substituted phenyl, wherein R₈ and R₉ are C₁-C₈alkyl or phenyl.

16. (new) A compound of formula I



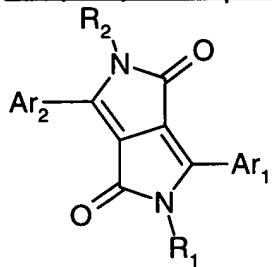
I

, wherein



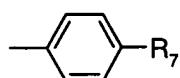
R₁ and R₂ are C₁-C₈alkyl, or -(CH₂)_m-Ph, Ar₁ and Ar₂ are a group of formula -OR₁₀, -N(R₈)₂, or unsubstituted or substituted phenyl, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, or halogen and R₈ is C₁-C₈alkyl, phenyl or a heterocyclic radical, both unsubstituted or substituted, or C₅-C₁₂-cycloalkyl.

| 17. (new) A compound of formula I

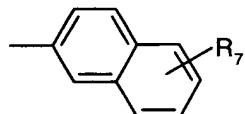
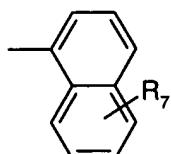


I , wherein

R₁ and R₂ are -CH₂-Ph, wherein phenyl can be substituted with phenyl, naphthyl or C₁-C₄alkyl up to

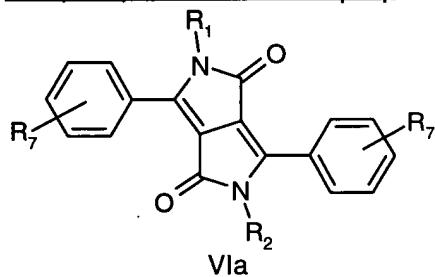


two times, Ar₁ and Ar₂ are a group of formula , wherein R₇ is C₁-C₈alkyl or phenyl, or a group of formula



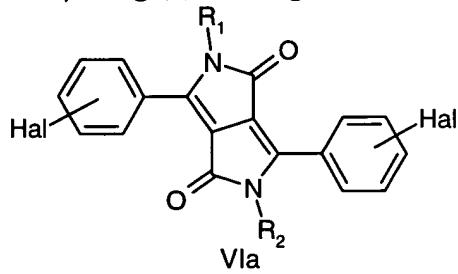
, or , wherein R₇ is hydrogen or OMe.

18. (new) Process for the preparation of compounds represented by formula VIa

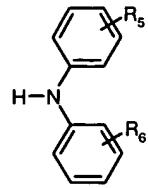


VIa

comprising (a) treating in a first step the DPP derivative of formula VIa or formula VIb



VIa



wherein R₈ stand for -NR₉R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or independently from each other, stand for hydrogen, cyano, halogen, C₁-C₂₅-alkyl, -NR'₉R'₉, -OR₁₀, -S(O)_nR'₈, -Se(O)_nR'₈, wherein

R₈ and R₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms,

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈-alkyl, C₁-C₈-alkoxy, or halogen, or

R₈ and R₉ stand for -C(O)R₁₁, wherein R₁₁ can be C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, R₁₀, -OR₁₂ or -NR₁₃R₁₄, wherein R₁₂, R₁₃, and R₁₄ stand for C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, C₆-C₂₄-aryl,

R'₈ and R'₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈-alkyl, C₁-C₈-alkoxy, or halogen, or

or -NR₈R₉ stands for a five- or six-membered heterocyclic radical in which R₈ and R₉, together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂-, or

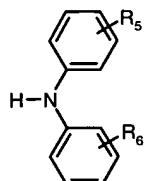
-CH₂-CH₂-NR'₅-CH₂-CH₂-, wherein R'₅, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆-alkyl, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈-alkyl or C₁-C₈-alkoxy, and n stands for 0, 1, 2 or 3,

R'₈ and R'₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ is as defined above, or

R₈ and R₉ stand for -C(O)R₁₁, wherein R₁₁ is as defined above,

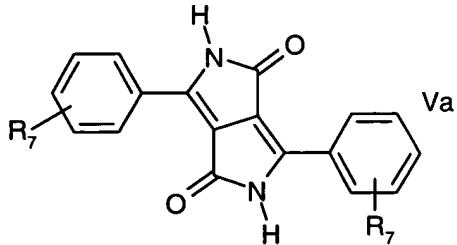
or -NR'₈R'₉, stands for a five- or six-membered heterocyclic radical in which R'₈ and R'₉, together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂-, or -CH₂-CH₂-NR'₅-CH₂-CH₂-, wherein R'₅ stand for hydrogen, cyano, halogen, C₁-C₆-alkyl, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈-alkyl or C₁-C₈-alkoxy, and n is as defined above,

R₁ and R₂ are independently from each other, hydrogen, C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₈-alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄, independently from each other stand for hydrogen, C₁-C₆-alkyl, or phenyl which can be substituted one to three times with C₁-C₃, Hal stands for halogen, with a nucleophilic agent selected from a selected from -NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or



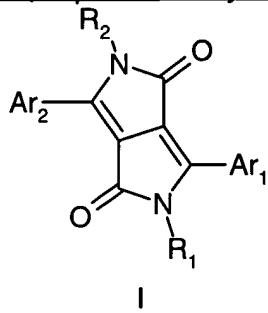
, in a molar ratio of DPP VIa or VIb:nucleophilic agent in the range of 1.2:1 to 0.8:1, or, if R₂ has the same meaning as R₁ in the range of from 1:2.5 to 1:1, in the presence of an anhydrous dipolar aprotic solvent, and of an anhydrous base in an amount in the range of from

0.1 to 15 moles per mole of the nucleophilic agent, at a temperature in the range of from 100 to 220°C and under a pressure in the range of from 100 to 300 kPa, and optionally isolating the obtained compound



(b) then treating the obtained compound Va, wherein R₇ is as defined above, with a base, thereafter in a second step, treating the reaction mixture obtained in the first step of (b) with an alkylating agent, wherein in the first step of (b) the base is a hydride, an alkali metal alkoxide or a carbonate, and the alkylating agent is a compound of the formula (R₁)₁ or ₂X, wherein X stands for SO₃⁻, (p-Me-phenyl)-SO₃⁻, (2,4,6-trimethyl-phenyl)SO₃⁻, -CO₃⁻, -SO₄⁻, or halogen, or a mixture of (R₁)₁ or ₂X and (R₂)₁ or ₂X.

19. (new) Electroluminescent device according to claim 1, wherein, wherein the light-emitting substance is a diketopyrrolopyrrole ("DPP") represented by formula I

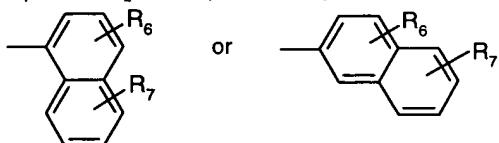


I

wherein R₁ and R₂, independently from each other, stand for C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₈-alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄, independently from each other stand for hydrogen, C₁-C₈-alkyl, or phenyl which can be substituted one to three times with C₁-C₈-alkyl,

Ar₃ stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈-alkyl, C₁-C₈-alkoxy, halogen or phenyl, which can be substituted with C₁-C₈-alkyl or C₁-C₈-alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4,

Ar₁ and Ar₂, independently from each other, stand for



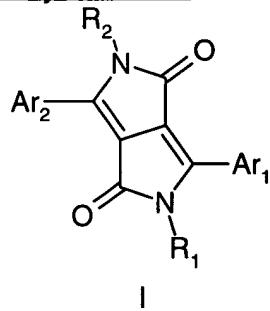
, wherein

R₆ and R₇, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆-alkyl, -NR₈R₉, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈-alkyl or C₁-C₈-alkoxy,

wherein R₈ and R₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, R₁₀, wherein R₁₀ stands for C₆-C₂₄-aryl, or a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms.

wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein Ph, the aryl and heterocyclic radical can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, or halogen, or R₈ and R₉ stand for -C(O)R₁₁, wherein R₁₁ can be C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, R₁₀-OR₁₂ or -NR₁₃R₁₄, wherein R₁₂, R₁₃, and R₁₄ stand for C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, C₆-C₂₄-aryl, or R₆ and R₇, independently of one another, stand for a saturated or unsaturated heterocyclic radical comprising five to seven ring atoms, wherein the ring consists of carbon atoms and one to three hetero atoms selected from the group consisting of nitrogen, oxygen and sulfur, wherein the heterocyclic radical can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy, or -NR₈R₉ stands for a five- or six-membered heterocyclic radical in which R₈ and R₉ together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂-, or -CH₂-CH₂-NR'-CH₂-CH₂-, wherein R' independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -OR₁₀, -S(O)_nR₈, -Se(O)_nR₈, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy, and n stands for 0, 1, 2 or 3.

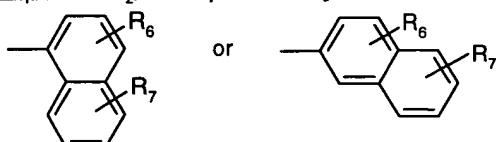
20. (new) Electroluminescent device according to claim 19, wherein the light-emitting substance is a diketopyrrolopyrrole ("DPP") represented by formula I



wherein R₁ and R₂, independently from each other, stand for C₁-C₂₅-alkyl, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄, independently from each other stand for hydrogen, C₁-C₆alkyl, or phenyl which can be substituted one to three times with C₁-C₃alkyl.

Ar₃ stands for phenyl which can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, halogen or phenyl, which can be substituted with C₁-C₈alkyl or C₁-C₈alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4.

Ar₁ and Ar₂, independently from each other, stand for

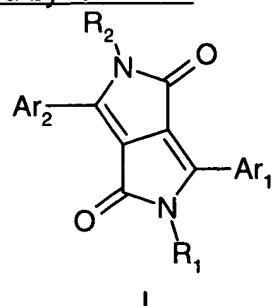


wherein

R₆ and R₇, independently from each other, stand for hydrogen, cyano, halogen, C₁-C₆alkyl, -NR₈R₉, -OR₁₀, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy, wherein R₈ and R₉, independently from each other, stand for hydrogen, phenyl, C₁-C₂₅-alkyl, C₅-C₁₂-cycloalkyl, -CR₃R₄-(CH₂)_m-Ph, or

-NR₈R₉ stands for a five- or six-membered heterocyclic radical in which R₈ and R₉, together stand for tetramethylene, pentamethylene, -CH₂-CH₂-O-CH₂-CH₂-, or -CH₂-CH₂-NR'-CH₂-CH₂-, wherein R' independently from each other, stand for hydrogen, C₁-C₆alkyl, or phenyl, which can be substituted one to three times with C₁-C₈alkyl or C₁-C₈alkoxy.

21. (new) Electroluminescent device according to claim 1, wherein the light-emitting substance is a diketopyrrolopyrrole ("DPP") represented by formula I



wherein R₁ and R₂, independently from each other, stand for C₁-C₂₅-alkyl, allyl which can be substituted one to three times with C₁-C₈alkyl or Ar₃, or -CR₃R₄-(CH₂)_m-Ar₃, wherein R₃ and R₄, independently from each other stand for hydrogen, C₁-C₈alkyl, or phenyl which can be substituted one to three times with C₁-C₈alkyl,

Ar₃ stands for phenyl or 1- or 2-naphthyl which can be substituted one to three times with C₁-C₈alkyl, C₁-C₈alkoxy, halogen or phenyl, which can be substituted with C₁-C₈alkyl or C₁-C₈alkoxy one to three times, and m stands for 0, 1, 2, 3 or 4.

Ar₁ and Ar₂, independently from each other, stand for

